Successful Surgical Management of Advanced Xanthomatosis in a Leopard Gecko, *Eublepharis macularius*

Scott D. Reed[1], DVM, DABVP, Frances M. Reed[2], DVM, William L. Castleman[3], DVM, PhD, DACVP

1. Pathobiological Sciences, School of Veterinary Medicine, Louisiana State University, Baton Rouge, LA 70803, USA

2. Petpatcher Veterinary Services, 4343 Hyacinth Avenue, Baton Rouge, LA, 70808, USA

3. Department of Pathobiology, University of Florida, College of Veterinary Medicine, Gainesville, FL 32611, USA

ABSTRACT: This is the first report of xanthomatosis in a leopard gecko, *Eublepharis macularius,* and is also the first report of successful surgical management of xanthomatosis in geckos. Clinical findings, surgical management, and post-operative follow up are described. Histopathologic findings of the xanthoma were consistent with previous reports. Similar to other authors' findings, this gecko was a female, suggesting a gender-associated problem in geckos.

KEY WORDS: Xanthoma, Xanthomatosis, leopard gecko, *Eublepharis macularius,* cholesterol, cholesteatoma.

INTRODUCTION

A five-year-old, captive-bred, female leopard gecko, *Eublepharis macularius,* presented with a history of lethargy, anorexia, scant urate droppings, and abdominal enlargement over the past couple months. Housing consisted of an 29 gal aquarium with a large water dish, a hiding rock and a piece of driftwood. The substrate was indoor-outdoor carpeting and the aquarium was maintained between 25°C (78°F) and 29°C (85°F). A full-spectrum reptile light elevated approximately 20 cm from the enclosure floor and replaced every six months was on a 12 hr on-off cycle. The enclosure was maintained between the ambient room temperature of 25°C (78°F) at night and increased to 29°C (85°F) during the day using a combination of heating pads and light. Until two months prior to presentation, the gecko had been fed two to three neonatal (pinky) mice each week augmented with occasional crickets and a variety of local insects. In the last two months, inappetence progressed to total anorexia.

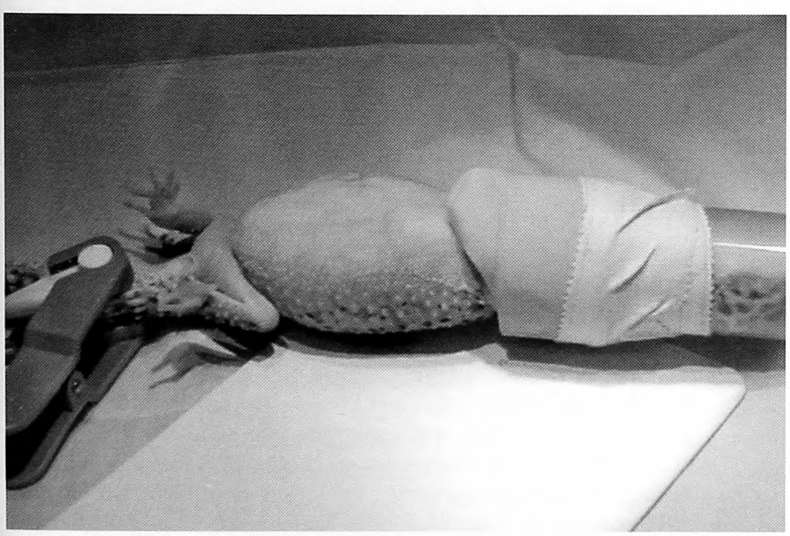

Figure 1. Leopard gecko, *Eublepharis macularius*, was maintained on isoflurane in oxygen and monitored by pulse oximetry throughout surgery.

On physical examination, the gecko weighed 36.5 g and was markedly cachectic despite having a large abdomen. Tail fat stores were completely depleted and muscles were atrophied. The hydration deficit was estimated to be approximately 10% based on sunken eyes and very prominent skin folds. Attitude was depressed and the lizard made little attempt to move during examination. Transillumination of the abdominal coelomic cavity revealed a cranially displaced liver and a large pale firm abdominal mass with several prominent blood vessels. Radiographs confirmed dorsal displacement of the gastrointestinal tract and a large mass occupying most of the caudal coelomic cavity. Other radiographic findings were within normal limits. Fecal staining, direct mount, and centrifugation-assisted floatation revealed no significant findings. Aspiration and cytology of the abdominal mass yielded acellular amorphous debris with occasional cholesterol crystals.

An exploratory ceiliotomy was elected to remove the mass compressing coelomic organs and to obtain a definitive diagnosis. The gecko was induced with 55 mg/kg ketamine hydrochloride (Ketaset®, 100 mg/ml, Fort Dodge Animal Health, Overland Park, KS) IM at 23°C (73°F) because of problems with breath-holding encountered when geckos are induced with gas anesthetic and because we were unable to access a vein for intravenous induction agents. Anesthesia was maintained with 3 – 4% isoflurane in oxygen and the gecko was monitored by pulse oximetry.

After routine surgical preparation with alternating chlorhexidine and sterile saline scrubs, a paramedian ventral midline incision (avoiding the median ventral abdominal artery) extending from the xyphoid to the pubis was made. A

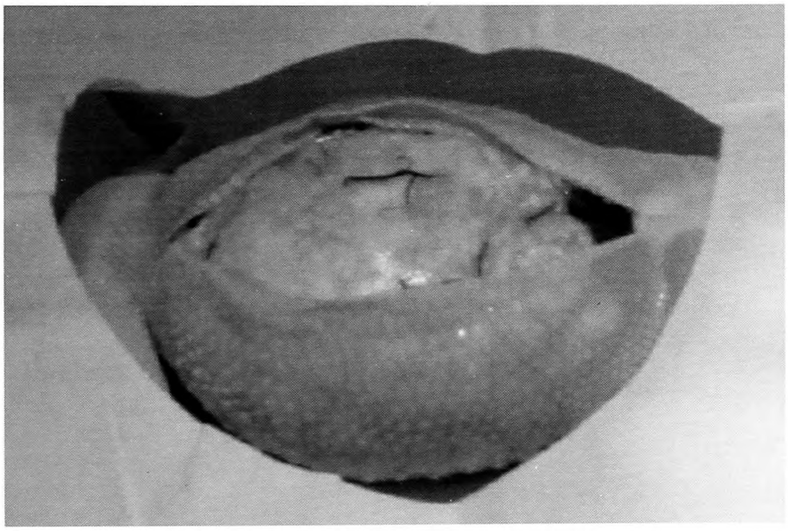

Figure 2. Ventral view of xanthoma after midline celiotomy.

Figure 3. Empty gastrointestinal tract and large abdominal void post xanthomectomy.

white glistening mass occupied most of the surgical field (Figure 1). Major vessels supplying the mass were divided and ligated with small LC-100 Ligaclips® (Ethicon, Somerville, NJ). The mass was able to be dissected free from surrounding tissue intact and was elevated from the abdomen revealing an empty, severely compressed gastrointestinal tract along the dorsal midline (Figure 2). Several additional similar masses ranging in diameter from 1 mm to 4 mm were removed from the lung surfaces, the pericardium, and the liver. The coelomic cavity was closed with a single simple continuous everting pattern of 5-0 polydioxanone (PDS-II®, Ethicon, Summerville, NJ). Recovery was uneventful. The gecko's post-operative weight was 26 grams.

Histopathology of the large abdominal mass and one of the smaller masses revealed sections without natural borders composed primarily of large amounts of clear acicular material consistent with cholesterol clefts, surrounded by and interspersed with large numbers of macrophages and lesser numbers of multinucleated giant cells. The tissue was divided into poorly defined streams and bundles by variable amounts of eosinophilic fibrillar to amorphous connective tissue. There were large loose collections of lymphocytes and plasma cells throughout the sections. There also were numerous small caliber blood vessels coursing throughout the tissue, and several of these contained intramural collections of lymphocytes and macrophages. Findings were diagnostic for xanthomatosis.

Two days after surgery, the gecko voraciously ate a single pinky mouse. A week later, the gecko was eating three pinky mice at a time and was active, alert, and appeared normal. After four weeks and two cycles of ecdysis, sutures were removed. At this time, tail fat stores were re-established and the 68.8 g gecko seemed to be thriving (Figure 4).

At follow-up one year later, the gecko was still thriving, weighed 74.2 g, and had no evidence of return of the xanthomatosis on physical examination and trans-illumination. Behaviorally and neurologically, the gecko appeared absolutely normal (Figure 5).

Discussion

To our knowledge, this is the first reported case of xanthomatosis in *Eublepharis macularius*. Furthermore, this is the first case of pre-mortem diagnosis and successful surgical intervention in geckos. Xanthomatosis has been reported in five other species of geckos post-mortem (Garner, *et al*, 1999). Xanthomas have also been reported in numerous other species including frogs (Carpenter, *et al*, 1986 and Russel, *et al*, 1990), snakes (Ryan and Whitney, 1980), birds (Latimer, 1994), cats (Grieshaber, *et al*, 1991; Wisselink, *et al*, 1994; Chanut, *et al*, 2005), dogs (Gumbrell, 1972, Chastain and Graham, 1978), horses (Summers, 1995) and humans (Murphy, *et al*, 2005).

Xanthomas are nodular accumulations of cholesterol and lipid-laden macrophages. They are often associated with excesses in serum cholesterol with aberrant triglyceride and/or lipoprotein levels (Goldschmidt and Hendrick, 2002). Various locations have been reported—oftentimes the skin is the only organ involved in people and small mammals. In the only previous report of xanthomatosis in geckos, a series of five geckos with xanthomatosis, xanthomas were reported in the coelomic cavity and the lateral ventricles of the brain (Garner, *et al*, 1999). In the aforementioned publication, two of the geckos had neurologic signs attributed to xanthomas within the lateral ventricles and consequent hydrocephalus. All the geckos had xanthomas on post-mortem examination and all geckos experienced significant morbidity and mortality directly attributed to the xanthomas (Garner, *et al*, 1999). Left untreated, the large coelomic cavity xanthoma in our patient would have also been fatal because of starvation secondary to severe compression of the gastrointestinal tract. Given that all reported geckos with xanthomatosis were female, Garner, *et al*, speculated that the xanthomas may have arisen because of alterations in cholesterol metabolism secondary to folliculogenesis, follicular degeneration, and/or yolk coelomitis (Garner, 1999). Indeed, our patient was also a female lending credence to the notion that xanthomatosis appears to be a gender-related condition in geckos. Another

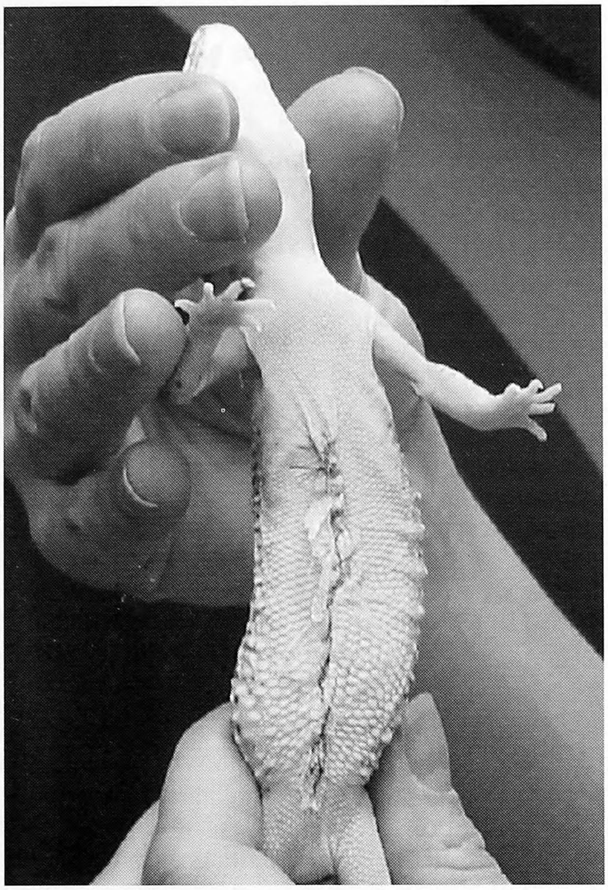

Figure 4. Appearance at suture removal, one month after surgery.

Figure 5. Appearance at follow-up one year after surgery.

factor that may have predisposed this gecko to xanthomatosis is the high fat diet composed almost exclusively of neonatal mice. Although some variety was provided by feeding field-caught insects, this practice is not recommended because of possible pesticide contamination.

Because the gecko of our report did not have a complete necropsy as described in Garner, *et al*; we could not confirm the presence or absence of xanthomas in the lateral ventricles of the brain, nor could we confirm hydrocephalus. Although there were no signs of neurologic disease in the gecko in this report, we could not rule out subclinical disease. All postural responses, activity levels, and eating behavior returned to normal quickly after surgery. Additionally, Garner, et al, were able to show elevated cholesterol levels on blood obtained from geckos in their series. In our case, pre-surgical blood work including cholesterol and triglyceride levels would have been ideal to determine association of the xanthomas with abnormal serum chemistry values. The stress of obtaining sufficient blood for analysis in this severely debilitated gecko prevented us from obtaining this data.

In summary, xanthomatosis appears to be a problem in females of several different gecko species. The prognosis for surgical removal of xanthomas and management of these patients can be very good with surgical intervention.

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